Dhruv Patel

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Education

Sardar Vallabhbhai National Institute of Technology(SVNIT) Surat, India
Bachelor's of Technology, Electronics and Communication; CGPA: 8.39/10 *2016 - 2020*

Publications

Kalwar S*, **Patel D***, Aanegola A, Konda KR, Garg S, Krishna KM, "GDIP: Gated Differentiable Image Processing for Object Detection in Adverse Conditions", Accepted at **ICRA 2023**. [WebPage] [Code] [Paper]

Srivastava K*, **Patel D***, Jha AK, Jha MK, Singh J, Sarvadevabhatla RK, Ramacharla PK, Kandath H, Krishna KM, "UAV-based Visual Remote Sensing for Automated Building Inspection (UVRSABI)", presented at the CVCIE Workshop, **ECCV 2022**. [WebPage] [Code] [Paper]

Patel D*, Jain A*, Bawkar S, Khorasiya M, Prajapati K, Upla K, Raja K, Ramachandra R, Busch C, "SRTGAN: Triplet Loss based Generative Adversarial Network for Real-World Super-Resolution", presented at the 7th International Conference on Computer Vision & Image Processing (CVIP) 2022. [WebPage] [Code] [Paper]

Patel D*, ShankaraNarayanan H.*, Gandhi M* & Darji A, "Design of an Autonomous Agriculture Robot for Real Time Weed Detection using CNN", presented at the AVES 2021 conference. [Code] [Paper]

Experience

Robotics Research Centre, IIIT Hyderabad July 2021 - Present
Research Associate *Hyderabad, India*

- **Scene Understanding for Autonomous Driving** *Advisors: Prof. Madhava Krishna & Dr. Sourav Garg*
  → Working with the ZF Friedrichshafen (ZF) group and QUT Centre for Robotics, Queensland University, on improving scene understanding for adverse weather conditions.
  → Proposed Gated Differentiable Image Processing (GDIP) framework for object detection, which significantly improves over the current state-of-the-art (SOTA) by 5.84 and 16 mAP on real-world foggy and dark conditions, respectively. Can operate at ∼3x speed over SOTA. (Accepted at **ICRA 2023**).
  → Currently working on video object detection by modeling motion and appearance. Also, exploring Probabilistic Graphical Models (PGM) for learning weather-agnostic features for object detection.
- **DodgeDrone - Visual Servoing for UAVs** [WebPage] *Advisor: Prof. Madhava Krishna*
  → Devising a high-level control strategy using vision, Imitation Learning (IL), and Reinforcement Learning (RL) for obstacle avoidance.
- **UAV-based Assessment of Civil Structures** [Website]
  → Led the iHub Project Mobility on building a vision pipeline for estimating critical seismic structural parameters.
  → Utilized concepts like Structure-from-motion, 2D-3D registration, and State estimation in conjunction with visual inspection algorithms based on classical Computer Vision and Deep Learning to achieve robustness.
  → Developed an open-source software library (UVRSABI) for the community. Collaborating with the Central Road Research Institute (CRRI), Govt. of India, for its real-world deployment.

Amdocs Aug 2020 – June 2021
Associate Software Engineer *Pune, India*

- Worked on full-stack software development - developing backend APIs (Java), user-friendly frontend UI (ReactJS) and writing SQL scripts for managing large-scale production databases.
- Conducted knowledge transfer sessions of various internal applications and followed programming practices.

Swaayatt Robots April 2020 – July 2020
Research Intern, advised by Founder Mr. Sanjeev Sharma *Bhopal, India*

- Worked on improving Visual Odometry (VO) and SLAM pipelines for Level-5 Autonomous Driving task.
- Proposed a semantic variant of the Iterative Closest Point (ICP) algorithm incorporating a class-specific loss function in the least squares optimization. It outperformed vanilla ICP, improving the matching loss and convergence time by 97% and 50%, respectively, on the Semantic KITTI dataset.[Report] [Appreciation Letter]

*equal contribution

SVNIT May 2019 – July 2019
Summer Research Intern, advised by Dr. K.P. Upla *Surat, India*
- Built a Face Recognition system using Deep Learning by implementing an NN4 variant of the inception network.
- Validated the system on a custom-made facial image dataset of 25 students.

Projects and Extra-Curricular

UG Project- Autonomous Agricultural Robot [Code] Oct 2019 – June 2020
[Funded by TEQIP-III] [Featured in ROS Agriculture Community]
- Developed the software stack for autonomous navigation and teleoperation of a 4-wheel skid-steer drive using RGB camera, GPS and IMU.
- Implemented a light-weight encoder-decoder architecture for crop-weed classification task, having 100x lesser parameters than UNet. Achieved 96.48% accuracy and 0.0168 units loss on CWFID whereas 99.471% mean accuracy, 98.035% mean IoU and loss of 0.0035 units on the Bonn dataset. Low latency of ∼2.5 fps (on Nvidia 940MX).
- Contributed to the structural design of the robot using URDF and SDF modeling.
- Prepared a seminar report on the robotic vision system design, primarily focusing on semantic segmentation and classification algorithms for the crop weed classification problem.

National Robotics Contest - Robocon [WebPage] Aug 2017 - June 2019
- Represented SVNIT at Robocon 2018 & 2019, an Asia-Pacific college robot competition.
- Developed the autonomous motion of holonomic drives using line following and odometry through feedback from line sensor, Gyroscope, IMU and Encoders.
- Built the software stack on Atmel AVR and ARM microcontrollers and also designed hardware circuitry using General Circuit Boards.
- As a senior member of a 15-person team, oversaw technical and managerial aspects in building 2 robots: a 4-wheel Holonomic Drive and Quadruped Robot in Robocon 2019.

Drishti - Tech Club SVNIT [Website] July 2017 - June 2019
- As a core member, organized project exhibitions like INSIGHT 1.0 (2019), where 500+ people, including students, professors, and L&T company executives, visited and interacted with the team.
- Organized workshops related to Embedded systems, Computer Vision and Robotics, and mentored projects (RFID-based Identification system, Wireless control of mobile Robot, etc.), at institute-level for junior students.
- Represented SVNIT at National Robotics Contest Robocon 2018 & 2019.

Courses And Certifications

Deep Learning Specialization, Coursera
Deep Learning & Applications, MeitY, Govt. of India [Link]
Academic & Business Writing, UC Berkeley, EdX [Link] Score: 93%
Fundamentals of Reinforcement Learning, Uni. of Alberta, Coursera [Link] Score: 98.98%
Attended the 6th CVIT Summer School on AI [Link]
Linear Algebra, MIT OCW, Prof. Gilbert Strang
Reinforcement Learning, UCL, David Silver

Awards And Achievements

- *UVRSABI* was selected for spotlight presentation at the CVCIE Workshop at ECCV 2022 and was inaugurated by *Dr. S. Velmurugan* (Chief Scientist, CRRI) to deploy in Telangana (India).
- Recognized as one of the top-performing employees at Amdocs by manager Mr. Ben Shasha.
- *AGRIBOT* was well-acclaimed by the Govt. of India for validating POC, and we also presented it at the ROS Agriculture community meet.
- Secured 13th rank in the final round of Robocon 2019 nationals and 12th rank in Robocon 2018 nationals among over 100+ participating universities.
- Best Working Model - Stirling Engine at the National Science Day Celebrations, Physical Research Laboratory (PRL) during 12th grade.

Technical Skills

Languages: Python, C/C++, Java, JavaScript, Embedded C, SQL
Tools & Frameworks: Git, Robot Operating System (ROS), Spring, Jenkins
Libraries: Matlab, PyTorch, TensorFlow, Pandas, NumPy, SciPy, Matplotlib, OpenCV, Point Cloud Library (PCL)